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ABSTRACT

This paper addresses some design considerations for computer-produced visual displays that are intended for either local or remote audiences of social workers. The project, "Building Family Foundations," expects to design and produce 10 different educational modules, including: child development; family issues--separation and attachment; family based treatment strategies; legal issues and court procedures; professional ethics; practice skills I and II; stress management; abuse and neglect; and adolescents. Many considerations must be made in the design process: Who is the audience? How should the modules be used? module product components; features; screen design; movement logical flow; team approach; features; and video master tape format. Information display can be organized into three perspectives within the image, structure, meaning, and impact, and each of those is discussed. The "Building Family Foundations" project incorporates the best features of multimedia instruction, and hopes to enhance learning through good instructional design and appropriate use of visual imagery. (Contains 30 references.) (MAS)

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Developing Hypermediated, Videodisc Training for Child Welfare Personnel: Bringing Visually Rich Training to Rural Areas

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Rural areas are blessed with many advantages, but access to professional development activities is limited. Like other professionals, child welfare workers need access to further skill and career development. Professional development activities for child welfare workers generally lead to better services for the children and their families. For child welfare workers in rural areas, opportunities for professional development usually require the time and expense of traveling to a central site to participate in training at a specific time. This can mean spending one day at a workshop, but with an extra day for traveling tacked on before and after the workshop, there is the potential of being away from the office for a least part of three continuous days.

Distance education has become an increasingly popular form of continued education and training for adult audiences in rural settings. One solution to providing access to further professional development is to offer course work at the rural worker's own site. Multimediated courses offered at their own work site and according to their own schedule can provide a solution to professional develop for rural workers.

The increasing workplace demands on social workers require a feasible solution to providing in-service training for those who reside in rural areas. Social workers need to know more information, yet increased responsibilities make it difficult to leave the office. While distance learning opportunities have multiplied greatly in the past several years, the lack of relevant course work and access to the technology necessary to participate in these opportunities may prohibit the wide use of distance education for rural social workers.

In a rural, midwestern state, two major institutions identified specific training needs for child welfare workers and set a five-year plan to meet them. The training plan calls for design and development of highly visual multimedia instructional units that can be transported to rural areas and used independently. The end result is a unique and visually powerful product that serves training needs in a rural area and provides continuing education credits toward career advancement.

The increased capability and availability of computers for education has led to questions about the potential applications and impact of this medium on the teaching and learning process. The design of visual images can greatly promote or interfere with learning. Image design needs to consider several variables including, but not limited to, the audience and intended message, along with the medium and technological constraints.

When learners use computers on a local basis, they have opportunities to interact with the program. This interaction enables each learner to control the pace, length of a session, and path through the

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program (Jonassen, 1988). Distance education offers the ability to reach a larger range of students, but the technology often limits the type of interactive possibilities. Placing the multimedia at the distant site overcomes the technological barriers commonly associated with distance learning while offering all of the advantages of local instructional with the exception of ready access to an instructor.

Ongoing improvements in computer hardware and software have removed some of the former technological barriers and now computers can supplement text with colorful graphics in both static and dynamic modes. Computer-controlled multimedia presentations can display images that are either digitized such as those on CD-ROM, or analog format such as those played from a videodisc. Some equipment even allows a mix of both analog video and digital displays on the same screen.

Because computer and television screens contain similarities, there are some design considerations that are common to both media. Presentations that mix images from a computer with images from a videodisc, television camera, or other projected image generally follow the rules of televised video screen design with some special consideration for the computer-based medium. This paper addresses some design considerations for computer-produced visual displays that are intended for either local or distant audiences. It assumes that electronically-produced instructional images require different design considerations than those that are limited to print.

The project as a whole is called ***Building Family Foundations*** because its general goal, like that of the current social assistance programs, is family preservation. The five-year project expects to design and produce ten different modules of instruction each carrying three continuing education units from Kansas State University. The following lists highlight in brief form the main considerations of the project design.

Ten Courses In This Project

- Child Development
- Family Issues - Separation and Attachment
- Family Based Treatment Strategies
- Legal Issues and Court Procedures
- Professional Ethics
- Practice Skills I
- Practice Skills II
- Stress Management
- Abuse and Neglect
- Adolescents

DESIGN CONSIDERATIONS

There are numerous items to consider when designing a large project like this. Areas of special consideration to this project were some background information about the audience, the way that the modules would be used, product components requiring design and production, record keeping so that social workers could get credit for completion, screen design that optimizes desirable features within the limitations of our production capability, logical progression of movement throughout the program, production organization and tasks, planning and preproduction tasks, special features of the multimedia, and video format.

Who is the Audience?

- Background information
- General educational level
- Range of computer skill level
- Environment for using this training

How Should the Modules be Used?

- Independently in any order
- No prerequisites
- With accompanying workbook

Module Product Components

- Videodisc
- Computer Program on Hard Disk
- Computer Disk for Personal Record
- Workbook Documentation

Features

- Glossary
- Hot Words
- Content Map
- Individual Record of Progress
- Ability to Print Record Sheet and Score
- Bookmark so Learners Can Take a Break and Come Back
- Workbook Documentation in 3-Ring Binder for Easy Access to Pages. Some pages may be xeroxed and used with clients.

Screen Design

- Use Colors with Care and Purpose
- Visual Theme Throughout is Shapes
- Visual effect of Depth and Patterns
- Special Effects Used Only When They Add to the Instructional Purpose
- Layout and Font Legibility

Movement Logical Flow

- Learning Objectives Must Be Developed Prior to Content
- Path must create logical choices and allow learner control
- Transitions are Crucial
- Prerequisites Identified Early in Design

Team Approach

- Overlap Duties
- Instructional Designer
- Scriptwriter
- Graphic Artist
- Videographer, Standard Production
- Videographer, Special Effects
- Programmer
- Planning and Preproduction Tasks are the Majority of the Effort

Features

- Verbatim Option for Those Who Wish to Read the Text
- See Words or Review Audio
- Hot Words
- Content Map
- Workbook Reference

Video Master Tape Format

- Use of SVHS Video Master
- Is it Sufficiently Good Quality?
- Saves Money

INFORMATION DISPLAY

Information display can be organized into three perspectives within the image: structure, meaning, and impact of the image (see Figure 1). The structure of the image contains the essential elements of good screen design. These elements can enhance the learner's ability to perceive and interpret the intended message. This leads to the learner's ability to apply meaning within the given context. Finally, images add impact to text-based messages; they have the potential to both clarify the message and add emotional impact.

Structure Of The Image

The structure of the image first considers the visual as a whole, then its components and the elements of good screen design. In order for the various image components to work together, elements of well-planned screen design must weave the components together in an aesthetically pleasing and understandable format. Thus, one must consider both the image and the screen design.

The Image

The image contains a mix of components that can work together or separately to modify the intended message. As you read this section, try to visualize the possible image variations that result from influences such as text, color, graphics, animation, and multimedia.

Text. Since text dominates computer-based instruction (Soulier, 1988), it is important to design text displays that communicate clearly to the reader. With appropriate fonts and spacing, computer screens can work very well for presenting limited amounts of text. Large amounts of text work better in printed form (Soulier, 1988) since they induce eye fatigue (Hathaway, 1984; Mourant, Lakshmanan, & Chantadisai, 1981) and are likely to be forgotten when presented on the screen (Wager & Gagne, 1988).

In addition to the amount of text, its density, along with typographic cueing and the mix of upper-case and lower-case characters can affect legibility (Hartley, 1987; Hathaway, 1984; Morrison, Ross, & O'Dell, 1988; Ross, Morrison, & O'Dell, 1988). Variations in font type, size, and density along with direction and screen placement can add meaning to the text image. See how the word "perspective" has been used in Figure 2 to actually suggest the feeling of visual perspective. Attention to font variation gives the feeling of With the exception of titles, headings, or special effects, the text should contain a mix of upper and lower case letters.

No matter what the screen design, legible text requires an appropriate font that is properly spaced. There is disagreement about the appropriateness of serif or sans serif style fonts. Some authors claim that fonts with serifs, as opposed to block-style lettering, are a better choice for computer screens (Soulier, 1988). Yet others believe that sans serif fonts with proportional spacing provide a cleaner effect that is easier to read than their seriffed counterparts (Gibson & Mayta, 1992; Kemp & Dayton, 1985). Fonts with small serifs can add interest to the display, while elaborately-seriffed fonts are difficult to read, especially if the image is to be viewed on television or in a large room.

Text legibility also depends upon the point size of the font. The point size of text on a computer screen can range from 12 to over 100 points per inch and remain legible. However one should consider the intended usage when selecting point size. Images that are likely to be projected for large audience reading should not use a point size smaller than 26 (Gibson & Mayta, 1992) and images that are not likely to be projected or broadcast will seldom require an extremely large font. Also consider the user; when designing screens for young children or people with visual impairments, use a larger font.

Figure 1. *Effective Instructional Images*

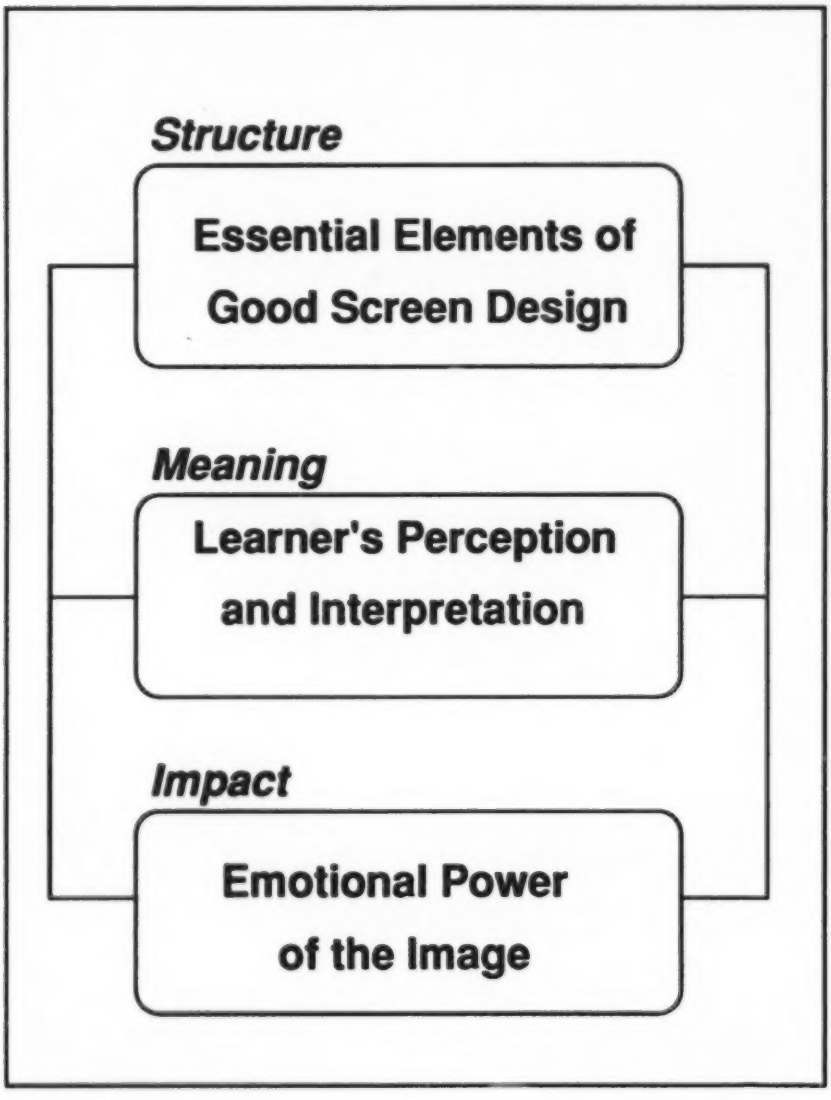

Figure 2. *Font Variation*

Section Overview
Topic The Developmental Process
It is important for social workers to be able to make assessments about a child's developmental level based on interviews, observations, and other tools that are part of an ecological perspective of development.
ecological

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In addition to style and size of the font, the weight of the typeface, line length, phrasing, and spacing between lines of text affect the legibility of computer screens. The weight of a font can vary from light, narrow, fine lines to heavy, broad, bold lines. A medium to bold weight is very good, depending upon the mix of elements on the screen. Gibson and Mayta (1992) recommend that bold typeface be used throughout all computerized screen images that are intended for broadcast so that the text shows up against the graphics. At the least bold fonts should be used for all titles and headings as well as for particular words that need emphasis. Drop shadows behind the text characters can add legibility if used carefully.

Because computers, monitors, software, and projection systems are becoming more capable, perhaps it is not as critical to adhere precisely to recommendations about font style and weight as it was in the past. An important contributing factor is the availability of good resolution provided by a VGA monitor and a quality projection device. Also, color can be provide visual cues within the text.

Color. Colors can be soft, harsh, or various combinations in between. Most of the computer software I have seen uses the palette of strong colors contrasts that are standardly available within computer presentation software. Our project team includes a graphic artist who looks for softer color mixes that use more subtle tones. These mixtures are very interesting and pleasant to look at.

Specific educational objectives can be enhanced by using color in visual illustrations (Dwyer, 1978), but while a few colors can cue the learner about the intended message, too many colors can be confusing. Color should assist the user in focusing on the material; it should never be a distraction (Gibson & Mayta, 1992). Accordingly, Hannafin and Peck (1988) suggest using a bright color to cue the learner for new information, while presenting the remainder of the information in standard colors consistent with the rest of the screen. Soulier (1988) recommends checking the program on a monochrome monitor and using a pattern as a backup technique to aid those people who are color blind.

The **Building Family Foundations** courseware uses color coding extensively. The actual variety of colors is limited, but the specific uses of color cue the learners to the meaning or function of specific screen objects.

A few colors with good contrast values will show up well on both color or monochrome displays, but an extreme contrast like stark white on a black background will cause bleeding and illegibility; it is better to use light grey to achieve the desired effect. Also avoid high values of red and orange because they can bleed into the surrounding colors.

In addition, certain colors that look ideal on an individual computer screen tend to flare or wash out when they are projected to a large screen or transmitted over a distance. To avoid disappointment it is best to experiment with a few color combinations using the equipment that will support the image when it is actually projected. Complementary colors with low saturation would have a good chance of working.

Graphics. Graphics add interest to the screen by providing visual variety (Kemp & Dayton, 1985) and offer another opportunity to suggest meaning to the learner. Possible graphic treatments range from simple to complex, from small monochromatic embellishments to dramatic, richly-colored, full-motion video images complete with sound effects.

Like verbal metaphors, visual metaphors can help us to understand an unfamiliar concept. Metaphoric graphics (Soulier, 1988) may be used to clarify a meaning within the computerized message, or they can guide the user through the mechanics or functionality of using the

software. For example, standard icons can symbolize the functionality of the software features and lesson flow.

Graphs that display data depend upon the reader's thought processing, interpretation, and comprehension; to be effective they must consider the intended visual message carefully. Sophisticated graphic displays that are designed to suggest inferences, generalizations, and evaluative interpretation can help students interpret meaning (Reinking, 1986; Singer & Donlan, 1980). High-level instructional graphics, such as symbolic, schematic, or figurative displays can be effective in teaching, and the visualization of abstract ideas through figurative displays may very well enhance learning (Nygard & Ranganathan, 1983). All graphics do not require the same level of detail and clarity, but even simple, decorative graphics at the pictorial level have their place. Indeed, Boyle (1986) suggests a need for designers to address cognitive processes by developing more materials for graphic thinkers, not just graphic readers.

This project uses graphics where possible. For example, to portray the normal growth and development of boys and girls at a variety of ages, the reader can select the gender and age, and then the computer displays the range of height and weight that is within the norm.

To assist with designing computer graphics, Soulier (1988) offers the following guidelines: keep illustrations appropriate for the audience; use simple line drawings when possible; preload graphics into the program so that they appear quickly on the screen; use standard symbols and symbolic representations; and keep graphics on the same screen in close proximity to the corresponding text message. These few tips can greatly improve the aesthetic appeal of a graphic and promote clarity of the message.

Most development software allows the use of simple animation to illustrate a motion, provide interest, or draw attention to particular areas of the screen (Kemp and Dayton, 1985). Although it is tempting to embellish the graphic, it is important to use animations only when appropriate and keep them short (Soulier, 1988).

This project uses a few well-placed animations that will aid the learner's comprehension of the material by, for example, gaining attention or illustrating a concept. When used sparingly animations can be effective, but they can become irritating, distracting, or disruptive to the thought process if overused or left on too long.

Screen Design

Good screen design aids the learner by using visual components to portray the message in a way that provides both clarification of information and visual interpretation. To visually aid the learner, it is necessary to consider the specific elements of good screen design as well as the general screen layout.

Elements of Good Screen Design. Interesting screens are composed of a variety of elements that work well together. Many of these elements are equally important so they are presented here in no particular order. The goal of good screen design is to use the various elements together to compose a simple, consistent design that provides sufficient information while avoiding clutter.

Unlike printed material which can be skimmed at will, the computer screen limits the learner's view of the overall content. Screen designs that are simple, straight forward, and consistent can help lead learners through the material, while complicated designs can lead to frustration. The basic simplicity of frame layout and user options does not restrict the ability to add interest and meaning with a full range of simple and complex graphics.

Certain user options should always be available. For example, status lines at the top or bottom of the screen that contain

consistent information help the learner assess progress and maintain some control over the program direction. The reader should control the display rate when possible so that there is adequate time to read the text, interpret the graphics, and consider the meaning of the message.

Menus should be clear, concise, uncluttered, and consistent. Icons within menus can be very helpful if the meaning of the icon is readily apparent. The range of possible choices in some programs can lead to cluttered or excessively layered menus; pull-down menus can be a solution. Highlighting or fading some menu choices will quickly give a visual cue about which items are currently available.

Ross and Morrison (1988) suggest using a hierarchical text display that is vertical and uses indentations similar to an outline. They further recommend a low-density text display with reduced wording and sentences limited to one main idea. It it also important to use care when splitting lines so that phrases remain complete Soulier (1988). Personal preference varies concerning single or double spacing of text, but do provide text breaks where the content allows.

In addition to font size, the text legibility is influenced by contrast with the background. Common considerations for both computer screens and video images suggest cool, neutral background colors like grey or blue instead of bright, very light, or very dark backgrounds. Tasteful use of enhancements such as outlining, inversed, or drop shadowed text can add to legibility.

Special techniques for changing the screen display, such as zooming, panning, tilting, and wiping onto the screen, can vary the viewer's perspective of the image. For example, a section of the screen can be enlarged to give a close-up view of specific details. Or the image can change from a long shot displayed in a small part of the screen to an extreme close-up showing part of the same image displayed in full screen mode. This technique can give the learner the sense of moving in to take a close look at the image. Imagine, for example, the visual effect of looking at a long shot of a group of trees in a small box on the screen and then changing to a full screen display of a close-up shot of leaf on one of those trees.

Screen Layout. The elements of good screen design work together to build a cohesive screen layout. The computer screen layout should never be visualized as a printed page filled with text, but guidelines similar to those offered for desktop published materials can be helpful. These include balancing text with white space, improving the aesthetics of the page, and positioning graphics as the dominant visual element (Parker, 1987). Designing the display with attention to legibility, the purpose of the particular frame, and consistent protocol, can result in visually interesting computer screens.

Like silence within oral communication, empty spaces can be used to advantage on the computer screen. For example the screen can be used to organize or highlight information, to draw attention to particular parts of the frame. The mix of graphics and text can provide a visual cue; so can boxing and grouping of information. Partitions, borders, standard icons, and consistent placement of common elements will visually aid the reader.

Generally headings are centered and bold, sometimes even boxed. For long or complicated sequences, subheadings can be used that include numbers or roman numerals to aid the reader in visually following the general flow of information. As a general rule, information should flow from the top, left part of the screen to the bottom, right part of the screen because that is the way people in our culture read.

Good layout technique depends upon an understanding that not all computer frames are alike. Hannafin and Peck (1988) address transitional, instructional, and question frames. Transitional frames are used to tie together

the different parts of the a computerized lesson: they provide an orientation to the beginning of, and various sections within, the program; they serve as bridges between various topics or sections; they provide feedback, directions, and instructions; and periodically, they present a progress report to let the learner gauge success. Instructional frames present basic information to the learner: these frames can alert the student to a need for prerequisite information; provide links between relationships from past and current learning; and provide definitions, examples, and rules. Question or criterion frames solicit input from the student to help individualize the instruction.

There are also variations to the general type of frames. For example, sometimes a frame contains both instruction and a question. Copy frames, prompt frames, hint frames, and interlaced frames are some types of variations (Hannafin & Peck, 1988). Copy frames provide information and a question about that information in the same screen. This type of format can be helpful in directing student attention, emphasizing important points, and for assuring a high degree of success for particular students. But because they are so obvious, copy frames are considered very elementary and need to be used sparingly.

Prompt frames direct the learner to supply input; these can be used effectively for questions as well as instructional screens. Hint frames are usually provided after a student has failed to enter an expected response; they offer guidance but do not supply the correct response. Interlaced frames are hybrids which combine various components from the standard frame types; they might include instruction, question, and feedback all on the same screen. This design can appear cluttered if not presented carefully but it has the advantage of allowing the student to visually examine and compare the question and feedback.

Each type of frame depends upon grouping of information in a way that visually aids the reader. To make optimal use of visual cues, it is helpful to design standard protocol for each type of frame and use it consistently throughout the program. Whatever protocol is chosen will need to comply with the overall program design. Programs that vary the screen location of pertinent information or procedures used to advance throughout the program can be confusing and frustrating (Mackey and Slesnick, 1982). Although standard protocol is necessary (Heines, 1984; Lentz, 1985; Simpson, 1984) designers can provide artistic variation to other parts of the screen to suggest meaning.

Meaning Of The Image

Information becomes valuable as it takes on meaning for an individual. Since visuals are meant to aid in the discovery of meaning, it follows that well-designed visuals will help students interpret the meaning. A learner's interpretation of the image can be affected by the text, type of graphic, and layout employed.

Layout must consider the principles of perceptual organization, which include similarity, proximity, continuity, and closure (Bloomer, 1976). These four processes, by which the mind organizes meaning, depend on how physically close the objects are, how similar they are, whether there is a continuous line to guide the eye, and whether the minimal amount of information is present that is necessary to obtain meaning or closure. Comprehension is directly affected by the way the mind organizes meaning from the placement of graphics and text.

Creating Meaningful Data Displays

Since powerful computers and software are now available to many people, the practice of transforming numerical data into visual displays is no longer limited to trained professionals. It follows that some design guidelines are needed.

There is a wide selection of software that produces graphs to tabulate or represent data. These data displays can take the form of circle or pie graphs, bar or chart graphs, line graphs, histograms, and scatterplots, among others. The ease of creation does not always result in good, meaningful graphics. It is important to follow some common sense approaches to graphical data display, whether the information is to be used on or off the screen, locally, or at a distance.

It is tempting to use various software features to make elaborate and colorful graphs, but in reality simple is better when displaying data (Tufte, 1983). To help learners interpret the meaning of graphs, the ***Building Family Foundations*** project uses only those dimensions and colors that are necessary to convey the message; three dimensional graphs should only be used when the third dimension represents a third aspect of the data interpretation, and color should only be used for contrast as an interpretational aid.

Visual information is frequently misrepresented by lay people who produce data graphs without the benefit of proper guidance. This practice can be dangerous since it can confuse and mislead consumers. Computers are not responsible for poor visual design, but they make it possible for uninformed users to produce inadequate products.

Impact Of The Image

Computer graphics and appropriate screen displays have the power to communicate by adding an image to the text. Visual images can aid message interpretation and enhance learning. They can also add specific impact to the message by providing an emotional element that is beyond that of other communication strategies. Realism can be enhanced by providing a graphic component. Images can represent realistic data ranging from simple sketches or graphs to intricate displays or vividly emotional scenes. Virtual reality can even conjure up imaginary situations through artificial imagery.

This project uses imagery in either the videodisc mode or the computer-based mode, depending on what is needed. The videodisc has the potential for using motion or still as well as monotone or color images. The realism of images can add significant to the impact.

SUMMARY

Structure, meaning, and impact combine to produce effective instructional images that can be created on computers. The structure of the image considers both the components of computer images and the elements of good screen design; the interworkings of both produce effective instructional displays.

New levels of knowledge, a variety of media options, and sophisticated software, offer the ability to improve computerized images and their resulting products. Although text remains a very important part of computer communications, today's technology encourages the use of more more graphics.

Understanding and emotional impact can be enhanced through powerful computer imagery. The imagery can represent real situations or it can create an artificial situation that appears to be real. Today, artificial reality remains limited to a small set of applications and is accessible to a restricted range of people, yet its future potential is tremendous in terms of visual communications and educational impact.

The **Building Family Foundations** project tries to incorporate the best features of multimediated instruction. It hopes to avoid mistakes and enhance learning by attending to the practice of good instructional design and appropriate use of good visual imagery. The imagery can very greatly improve the understanding of students who are working independently at a distance without the benefit of an instructor's presence.

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